
APPENDIX B—BEST MANAGEMENT PRACTICES

INTRODUCTION

A Best Management Practice (BMP) is a state-of-the-art mitigation measure applied on a site-specific basis to reduce, prevent, or avoid adverse environmental or social impacts. BMPs are applied to management actions to aid in achieving desired outcomes for safe, environmentally sound, resource development by preventing, minimizing, or mitigating adverse impacts and reducing conflicts. For each proposed action, a number of BMPs may be applied as necessary to mitigate expected impacts. BMPs can be applied by incorporating them into individual project proposals as design features or incorporating them into the Bureau of Land Management's (BLM) authorization of the project as conditions of approval.

BMPs should be selected to meet the site specific requirements of the project and local environment. No one management practice is best suited to every site or situation. BMPs must be adaptive and monitored regularly to evaluate effectiveness. BMPs by their very nature are dynamic innovations and must be flexible enough to respond to new data, field research, technological advances, and market conditions. The BLM continues to improve the way it manages mineral development of the Public Lands. Part of that improvement includes the use of BMPs to lessen the effects of mineral development on the environment. The mineral industry and the BLM are constantly developing and improving BMPs.

The BMPs listed below may be applied to proposed mineral actions within the Moab Master Leasing Plan area. The list is not comprehensive and may be modified over time as conditions change and new practices are identified. Periodically, the BMPs may be updated to stay current with the latest technology and with the latest Department of Interior and BLM direction.

Construction and Operations (may also apply to soil, vegetation, visual resources, and wildlife)

- Well site locations should be planned in order to minimize long-term disruption of the surface resources and existing uses, and to promote successful reclamation.
- Existing roads will be used to the extent possible. All new roads and upgrades of existing roads will be designed to a safe and appropriate standard “no higher than necessary” to accommodate intended vehicular use and to reduce impacts to natural resources.
- Construction will not be conducted during wet conditions when soils are saturated.
- Drainage from disturbed areas will be confined or directed so as to not cause erosion in undisturbed areas.
- Construction of access roads on steep hillsides and near water courses will be avoided where alternate routes provide adequate access.
- Activities on slopes over 21 percent will be avoided to the extent possible.
- Access roads requiring construction with cut and fill will be designed to minimize surface disturbance; and will take into account the character of the landform, natural contours, cut material, depth of cut, where the fill material will be deposited, resource concerns, and visual contrast. Roads will follow the contour of the land where practical.

- Fill material will not be cast over hilltops or into drainages. Cut slope ratios should normally be no steeper than 3:1 and fill slopes no steeper than 2:1.
- Low water-crossings will be used whenever possible.
- Placement of facilities on hilltops and ridgelines will be avoided. Well site layout should take into account the character of the topography and landform. Deep, vertical cuts and steep, long fill slopes should be avoided. All cut and fill slopes should be constructed to the least percent slope practical.
- Trash will be retained in portable trash containers and hauled to an authorized disposal site. Burning of trash will not be allowed on the site.
- Cattle guards will be installed and maintained whenever access roads go through pasture gates or fences. Maintenance includes cleaning out under cattle guard bases when needed.
- All pits and open cellars shall be fenced in accordance with BLM specifications.
- The operator shall maintain the existing roads in a safe, usable condition. Maintenance shall include, but is not limited to, grading, ditching, installing low water crossings, and, if needed, surfacing the road with aggregate.
- Stockpile all brush, limbs, crushed stumps, and other woody material separately from topsoil. Use the stripped vegetation for interim reclamation.
- Repair/replace fences as necessary in order to prevent cattle access to project facilities. Fences will be constructed around reserve pits to prevent wildlife entry.
- Construct a berm of sufficient capacity to contain the storage capacity of the largest tank plus sufficient freeboard to contain 150 percent of the volume of the largest tank to surround the tank battery.
- Apply mat drilling techniques to accelerate and enhance reclamation by decreasing soil and vegetation disturbance.
- Locate well pads, associated facilities, and utilities in the least environmentally sensitive areas. Locate wells outside riparian areas, streams or drainages, below ridgelines, away from important sources of forage, cover, reproductive habitats, winter habitats, parturition areas, and brood-rearing habitats.
- Centralize and combine pipeline systems and other facilities and infrastructure to minimize disturbance during development and production.

Air Quality and Greenhouse Gas/Fugitive Dust (may also apply to soils, and vegetation, to wildlife)

- Water or alternative dust suppressants (i.e. surfactants or other erosion control materials) will be utilized to minimize fugitive dust during construction and applied on material (sand, gravel, soil, minerals, or other matter that may create fugitive dust) piles.
- All vehicles and construction equipment will be properly maintained to minimize exhaust emissions.

- In the absence of a pipeline, the preferred method of gas disposal is flaring, rather than venting.
- Restrict vehicle speeds to 10 miles per hour (mph) on well pads and production facility locations.
- Vehicles are not to exceed a speed of 20 mph on any unpaved road to discourage the generation of fugitive dust.
- Periodic watering or chemical stabilization of unpaved roads.
- Cover, enclose, or stabilize excavated or inactive material piles after activity ceases.
- Use telemetry and well automation to remotely monitor and control production.
- Use centrally stored water that is piped to the well pads through a temporary surface line.
- Centralize (or consolidate) gas processing facilities (separation, dehydration, sweetening, etc.).
- Construction and drilling crews will carpool to and from the site to minimize vehicle-related emissions.
- Use chip-seal or asphalt surface for long-term access.
- To the extent possible, utilize solar power to power well site equipment.
- Install vapor recovery units on all oil and condensate tanks.
- Minimize the period of time between initially disturbing the soil and revegetating or other surface stabilization. Utilize interim reclamation.
- Minimize the area of disturbed land.
- Prompt revegetation of disturbed lands.
- Enclose, cover, water, or otherwise treat loaded haul trucks to minimize loss of material to wind and spillage.
- Revegetate, mulch, or otherwise stabilize the surface of all disturbed areas adjoining roads.
- Reduce elemental carbon, particularly from diesel fueled engines by utilizing controls such as diesel particulate filters on diesel engines, or using lower emitting engines (e.g. Tier 2 drill rigs).
- Opportunities to reduce nitrogen oxides (NOx), particularly from internal combustion engines, should be pursued to control impacts to deposition and visibility in nearby Class 1 areas. This may include the use of lower emitting engines (e.g. Tier 2 drill rigs), and/or add on controls (e.g. selective catalytic reduction) where appropriate.
- Reduce nitrogen oxides (NOx), particularly from internal combustion engines, by controlling impacts to deposition and visibility in nearby Class 1 areas. This may include the use of lower emitting engines (e.g. Tier 2 drill rigs), and/or add on controls (e.g. selective catalytic reduction) where appropriate.

- To mitigate any potential impact oil and gas development emissions may have on regional ozone formation, the following BMPs would be required for any development projects:
 - Tier II or better drilling rig engines.
 - Stationary internal combustion engine standard of 2g NOx/bhp-hr for engines <300HP and 1g NOx/bhp-hr for engines >300HP.
 - Low bleed or no bleed pneumatic pump valves.
 - Dehydrator VOC emission controls to +95 percent efficiency.
 - Tank VOC emission controls to +95 percent efficiency.

Cultural Resources

- All persons who are associated with mineral operations will be informed that they will be subject to prosecution for knowingly disturbing archaeological sites or collecting artifacts.
- If any previously unidentified cultural resources or human remains are discovered as a result of mineral operations, activity in the vicinity of the discovery will cease and will be immediately reported to the BLM Field Office. Work may not resume at that location until approved by the BLM Authorized Officer.
- Use visual resource BMP's to avoid, minimize, or mitigate potential adverse effects to historic properties.

Visual Resources/Noise/Night Skies

Visual Resources

- Use natural or artificial features, such as topography, vegetation, or an artificial berm to help screen facilities. Design roads and other linear facilities to follow the contour of the landform or mimic lines in the vegetation. Avoid a straight road that will draw the viewer's eye and attention straight toward the production facilities at the end of the road.
- If electricity is used to power mineral operations, electric lines will be buried in or immediately adjacent to access roads.
- Paint above ground production facilities (pumping units, pipes, compressors, tanks, treaters, etc.) a color that allows the facility to blend into the background. Also, paint all new equipment brought onto the site the same color as approved by the BLM Authorized Officer.
- Semi-gloss paints should be used rather than flat paints; the selected paint color should be one or two shades darker than the background.
- During reclamation, replace soil, brush, rocks, shrub/tree debris, etc., over disturbed earth surfaces, which allows for natural regeneration rather than introducing an unnatural looking grass cover.
- Design well pads so that the edges are irregular and more natural-looking. Straight line edges should be avoided.
- Utilize "liquid gathering systems" (LGS) to eliminate surface storage tanks and reduce truck trips for removal of liquids.

- Place infrastructure within or near previously disturbed locations. Pipelines and electric lines will be buried in or immediately adjacent to access roads. Surface-laid pipelines would also be located in or immediately adjacent to access roads.

Noise (may also apply to wildlife)

- Minimize noise by using best available technology, such as installation of multi-cylinder pumps, hospital grade sound reducing mufflers, and placement of exhaust systems to direct noise away from sensitive receptors.
- Locate drill pads, roads, and facilities below ridgelines or behind topographic features to minimize auditory effects.
- Where equipment is located within the proximity of sensitive receptors, noise levels will not exceed 50 decibels above background noise.

Night Skies

- Limit the use of artificial lighting during nighttime operations to only those that are determined necessary for the safety of operations and personnel. During drilling operations, more lighting will be needed due to safety requirements.
- Utilize shielding and aiming techniques, as well as limiting the height of light poles to reduce glare and avoid light shining above horizon(s).
- Use lights only where needed, using light only when needed, and directing all lighting onsite.
- Use motion sensors, timers, or manual switching for areas that require illumination, but are seldom occupied.
- Reduce lamp brightness and select lights that are not broad spectrum or bluish in color.

Soil/Water (surface water and groundwater)/Riparian

- Minimize disturbance to natural drainage patterns. Design locations for storm conditions, ensure offsite natural runoff does not wash over site, and use perimeter drainage ditches.
- Divert storm water away from well locations with ditches, berms, or waterbars above the cut slopes to trap well location runoff and sediments on or near the location through the use of sediment fences or water retention ponds.
- Inspect equipment routinely for leaks (diesel fuel, hydraulic fluid, lubricating oil, and coolant) and make any necessary repairs. In the event of soil contamination due to equipment fluid spills, isolate and clean up the spill immediately. Implement soil remediation and bioremediation procedures or excavate to an appropriate container and transport to an approved offsite disposal location.
- During reclamation, apply certified weed free mulch or other suitable materials and crimp or tackify to remain in place to reclaim areas for seed retention.
- Construction will not be conducted during wet conditions when soils are saturated.
- In areas of identified biological soil crusts, the top 2 to 5 inches of topsoil, inclusive of the biological soil crusts, shall be carefully stripped and stockpiled separately from all other soil materials.

Organic matter and debris shall be retained in the piles to help sustain biological activity and increase the effectiveness of respreading the crust material. Storage piles shall be shallow to preserve microorganisms and seeds. Respread the soil crust during interim and final reclamation. During reclamation, reestablish mounds on the surface prior to reapplying the biological soil crusts.

- Stabilize topsoil stockpiles by 1) spraying with water to establish crust, and 2) cover with biodegradable product.
- Utilize erosion control structures, such as certified weed free straw bales, silt fences, sediment traps, waterbars, drainage ditches, and sediment ponds to prevent down cutting on slopes, to reduce loss of sediment, and to avoid contamination of runoff into perennial and intermittent streams. These structures will remain in place and will be maintained until stabilization and revegetation are complete.
- Regular monitoring of revegetated and reclaimed areas will be conducted with regular maintenance or reseeding as needed until the BLM determines that the revegetation is successful.
- Topsoil will be segregated and stored separately from subsurface materials to avoid mixing during construction, storage, and interim and final reclamation. Subsurface materials will never be placed on top of topsoil material at any point in the operation. Stockpiles will be located and protected so that wind and water erosion are minimized and reclamation potential is maximized. Ensure that the topsoil is spread evenly over the reclaimed area.
- Construction operations will not be conducted during wet conditions when soils are saturated.
- Use closed-loop drilling systems in sensitive areas or where there is shallow groundwater.
- Substitute less toxic, yet equally effective products, for conventional drilling products, such as mud and pipe dope.
- During the completion of a well, the operator shall, when required by the Authorized Officer (AO), conduct, test, run logs, and make other surveys reasonably necessary to determine the presence, quantity, and quality of oil, gas, other minerals, or the presence or quality of water. These tests and logs will be reviewed and correlated with geologic and hydrologic data.
- When needed or as determined by the AO, the operator shall conduct reasonable tests, which will demonstrate the mechanical integrity of the down hole equipment.
- Proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones. All isolating medium other than cement shall receive approval prior to use.
- Casing setting depth shall be calculated to position the casing seat opposite a competent formation based on relevant factors, including: presence/absence of hydrocarbons; fracture gradients; usable water zones; formation pressures; lost circulation zones; other minerals; or unusual characteristics.
- All indications of usable water will be reported to the Authorized Officer.
- Surface casing will be cemented back to the surface and is subject to BLM inspection and verification. If the primary cement job does not circulate back to surface, remedial cementing will be required.

- Surface casing will be set at a minimum depth of 50 feet below the deepest usable source drinking water.
- All formations bearing usable quality water will be protected by employing casing and cement.
- Run cement bond logs to verify the effectiveness of the casing cement job to ensure the protection of usable water bearing zones. When needed, or as directed by the Authorized Officer, the operator shall conduct reasonable tests and/or surveys, which will demonstrate the mechanical integrity of the down hole equipment.
- Set intermediate casing string where there is potential for encountering deep aquifers.
- Any cement plug that is the only isolating medium for a usable water interval shall be tested by tagging with the drill string. Any plugs placed where the fluid level will not remain static will also be tested.
- Proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones. Set intermediate casing string where there is potential for encountering deep aquifers. Casing setting depth shall be calculated to position the casing seat opposite a competent formation based on relevant factors, including: presence/absence of hydrocarbons; fracturing gradients; usable water zones; formation pressures; lost circulation zones; other minerals; or unusual characteristics.
- Disposal or emergency pits will be located in cut material rather than fill material.
- If water is encountered during construction of a pit, cease construction and immediately contact BLM.
- Avoid constructing reserve pits in areas of shallow groundwater. To prevent contamination of groundwater and soils, use semi-closed-loop or closed-loop drilling systems or lined pits with impermeable liners.
- Where operations are conducted in the vicinity of public water sources, the operator will work with the public water supplier to identify possible methods to protect water supplies.
- At a minimum, the operator and the BLM will adhere to BLM Instruction Memorandum 2010-055 regarding the Protection of Groundwater in Association with Oil and Gas Leasing, Exploration, and Development. Areas identified with shallow unconfined aquifers and potential unconsolidated aquifers will require additional mitigation that may include closed loop drilling, no surface pits, offsite location of production storage facilities; a spill prevention, control and countermeasure plan (as specified by the Environmental Protection Agency [EPA]); and a storm water management plan. A water monitoring plan may be required to ensure the effectiveness of mitigation to protect water resources.
- Construct all road and pipeline crossings at right angles to all riparian corridors and streams to minimize the area of disturbance.
- Avoid construction in wetland and riparian areas.
- Locate and construct all structures crossing intermittent and perennial streams and ephemeral drainages such that they do not decrease channel stability or increase water velocity.

- Minimize crossings of streams (intermittent and perennial) in wetlands with vehicles and heavy machinery.
- As specified by the Authorized Officer, reserve pits and other surface impoundments will be lined with synthetic liners with a minimum thickness of 12 millimeters or other materials, such as bentonite or clay. Decommission by removing all contaminants and liner and dispose of the liners in an approved waste management facility or recycle them. For additional siting and closure guidance, refer to IB No. UT 2013-038.
- All operations shall be in compliance with the State of Utah, Division of Water Quality rules at <http://www.rules.utah.gov/publicat/code/r309/r309.htm>.

Reclamation (may also apply to soil, vegetation, visual resources, and wildlife)

- Provide a reclamation plan as part of mineral proposals that includes plans for both interim and final reclamation. Reclamation is required of any disturbed surface that is not necessary for continued production operations. Additional reclamation measures may be required based on existing conditions at the time of final abandonment.
- Planning for reclamation should occur prior to construction in order to achieve successful reclamation in the future. Successful final reclamation is achieved more efficiently by locating operations in areas that minimize reclamation needs, the sufficient salvage of topsoil, and completion of interim reclamation.
- Reclaimed areas above pipelines receiving incidental disturbance during maintenance activities will be reseeded as soon as practical.
- Final reclamation of all mineral related disturbances will involve recontouring of all disturbed areas, including access roads to the original contour or a contour that blends with the surrounding topography and revegetating all disturbed areas to native species. It also involves salvaging and reusing all available topsoil (whatever soil is on top) in a timely manner, revegetating disturbed areas, controlling erosion, controlling invasive non-native plant and noxious weeds, and monitoring results. Reclamation measures should begin as soon as possible after the disturbance and continue until successful reclamation is achieved.
- The long-term objective of final reclamation is to set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats. In most cases, this means returning the land to a condition approximating or equal to that which existed prior to the disturbance.
- During the life of the mineral operation, all disturbed areas not needed for active support of the operation should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses. Reclamation is required of any disturbed surface that is not necessary for continued mineral operations.
- Disturbed areas should be revegetated after the site has been satisfactorily prepared. Site preparation will include respreading topsoil to an adequate depth, and may also include ripping, tilling, disking on contour, and dozer track imprinting.

- Any topsoil pile set aside should be revegetated to prevent it from eroding and to help maintain its biological viability.
- All pits must be reclaimed to a safe and stable condition that blends with the rest of the reclaimed area. If necessary, the pit area should usually be mounded slightly to allow for settling, to allow for positive surface drainage.
- Interim reclamation of the well pad and access road will begin as soon as practical.
- Facilities will be grouped on the pads to allow for maximum interim reclamation. Interim reclamation will include road cuts and fills and will extend to within close proximity of the well head and production facilities.
- Respread topsoil over the entire location and revegetate to within a few feet of the production facilities, unless an all-weather, surfaced, access route or turn-around is needed.
- The well site must be recontoured to original contour or a contour that blends with the surrounding landform, stockpiled topsoil evenly distributed, and the site revegetated. Salvaged topsoil must be respread evenly over the surfaces to be revegetated. The topsoiled site should be prepared to provide a seedbed for reestablishment of desirable vegetation.
- Final reclamation includes recontouring the road back to the original contour, seeding, controlling noxious weeds, and may also include other techniques to improve reclamation success, such as ripping, scarifying, replacing topsoil, constructing waterbars, pitting, mulching, redistributing woody debris, and barricading.
- Use stockpiled brush, limbs, crushed stumps, other woody material, and stripped vegetation for interim and final reclamation.
- Fencing will be installed to prevent livestock from grazing the reclaimed area until vegetation is reestablished.

Vegetation/Noxious Weeds and Invasive Species (may also apply to soils, visual resources, water, and wildlife)

- Avoid or minimize the loss of sagebrush/steppe and blackbrush habitat.
- In sagebrush/steppe habitat use the appropriate mix of sagebrush seed for reclamation.
- Operations conducted in sagebrush/steppe habitat will focus on maintaining large blocks of sagebrush habitat.
- Reseed or plant disturbed areas with desirable vegetation when the native plant community cannot recover and occupy the site sufficiently.
- Seeding performed as part of reclamation operations will take place in the fall from mid-October until mid-December when the ground surface is not frozen.
- Prior to commencing operations, all equipment and vehicles will be cleaned to remove seeds and soil that may contain seeds in order to avoid the spread of noxious weeds and invasive species.

- To minimize the potential of spreading weed seeds between drilling locations, compressed air will be used to remove weed seeds and soil from equipment before it is mobilized to the next drilling location.
- Develop a weed management plan on how to monitor growth of invasive species resulting from surface disturbance caused by project activities and how to control noxious weeds and invasive species through the application of commercial herbicides after obtaining a Pesticide Use Permit from the BLM.
- Treatment to prevent the introduction or spread of invasive/noxious plants would conform to the guidelines and principles of the Western States Environmental Impact Statement for vegetation treatments, which specifies herbicides approved for use, treatment protocols, mitigation, and monitoring.
- Construction equipment and vehicles will not be allowed to drive through weed-infested areas.
- Control noxious and invasive plants that become established along roads, on well pads, or adjacent to other facilities.
- Clean and sanitize all equipment brought in from other regions. Use portable washing stations to periodically wash down equipment entering and leaving well field areas, especially during muddy conditions. Seeds and propagules of noxious plants are commonly transported on equipment and mud clinging to equipment.

Wildlife

- Identify important, sensitive, and unique habitats and wildlife in the area. Incorporate mitigation practices that minimize impacts to these habitats.
- Plan the pattern and rate of development to avoid the most important habitats and generally reduce the extent and severity of impacts.
- Cluster drill pads, roads, and facilities in specific areas that would have a lower impact on wildlife habitat.
- Consider LGS to eliminate surface storage tanks and reduce truck trips for removal of liquids.
- Place infrastructure within or near previously disturbed locations in order to avoid new impacts to wildlife habitat.
- Advise project personnel regarding appropriate speed limits to minimize wildlife mortality due to vehicle collisions. Roads would be reclaimed as soon as possible after they are no longer required.
- Personnel will be advised to minimize stopping and exiting their vehicles in big game winter range when there is snow on the ground.
- Offsite mitigation for raptors: If it is found that project activities could potentially affect raptor nesting on or adjacent to the project area, as determined from decreased raptor productivity or nesting, or documented nest abandonment or failure, alternate nesting sites (ANS) may be constructed at a rate of up to two ANSs for one impacted nest. Existing degraded raptor nests may be upgraded or reinforced to minimize potential impacts. ANSs will be located within the nesting

territory of potentially affected raptor pairs, outside of the line-of-sight or nest buffer of actively nesting pairs, where possible.

- In order to minimize potential for raptor mortalities on production facility structures, raptor protection measures shall be applied (e.g., modify for raptor-safe construction, install perches, perching deterrents, nesting platforms, nest deterrent devices, etc.).
- If aerial power lines are to be used, they shall be designed and existing power poles should be modified, if possible, to prevent or minimize raptor perching and mortalities.
- To the extent possible, avoid activities and facilities that create barriers to the seasonal big game.
- In order to limit impacts to mule deer and elk, avoid aggressive non-native grasses and shrubs in mule deer and elk habitat restoration.
- In order to limit impacts to pronghorn antelope, avoid aggressive non-native grasses and shrubs in pronghorn habitat restoration.
- Offsite mitigation for pronghorn: In order to limit impacts to pronghorn, install offsite watering stations (guzzlers).
- If produced water is allowed to evaporate after completion of drilling, reserve pits will be fenced on four sides to prevent entry by wildlife and/or livestock.
- Promptly report observations of potential wildlife problems to the regional office of the Utah Division of Wildlife Resources (UDWR) and, as applicable, to the U.S. Fish and Wildlife Service (USFWS).
- The operator will notify the BLM Authorized Officer and nearest USFWS Law Enforcement office within 24 hours if the operator discovers a dead or injured Federally protected species (i.e., migratory bird species, bald or golden eagle, or species listed by the USFWS as threatened or endangered) in or adjacent to a pit, trench, tank, exhaust stack, or fence. (If the operator is unable to contact the USFWS Law Enforcement office, the operator must contact the nearest USFWS Ecological Services Office.)
- *Exclosure Fencing (Fluids Pits and Open Cellars)* – Design, construct, and maintain exclosure fencing for all open cellars and pits containing freestanding fluids to prevent access to livestock and large forms of wildlife, such as deer, elk, and pronghorn. At a minimum, the operator will adequately fence all fluids pits and open cellars during and after drilling operations until the pit is free of fluids and the operator initiates backfilling. The operator will maintain the fence in order to protect public health and safety, wildlife, and livestock.

(For examples of exclosure fencing design, refer to the Oil and Gas *Gold Book* – Exclosure Fence Illustrations, Figure 1, Page 18.)

Adequate fencing (in lieu of more stringent requirements by the surface owner) includes all of the following:

1. Construction materials will consist of steel and/or wood posts. Use a fence with five separate wires (smooth or barbed) or hog panel (16-foot length by 50-inch height) with connectors, such

- as fence staples, quick-connect clips, hog rings, hose clamps, twisted wire, etc. Do not use electric fences.
2. Set posts firmly in the ground. Stretch the wire, if used, tightly and space it evenly, from the ground level to the top wire, effectively keeping out animals. Tie hog panels securely into posts and to one another using fence staples, clamps, etc. Construct the fence at least 2 feet from the edge of the pit.
 3. For reserve pits, fence all four sides as soon as the pit is constructed. Reconstruct any damage to the rig side of the fence immediately following release of the drilling rig.
 4. Maintain the erect fences in adequate condition until the pit has been closed.
- *Exclosure Netting (Fluids Pits)* – The operator will prevent wildlife and livestock access (including avian wildlife) to fluids pits that contain or have the potential of containing salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, surfactants, or Resource Conservation and Recovery Act-exempt hazardous substances. At a minimum, the operator will install approved netting in these circumstances, in accordance with the requirements below, immediately following release of the drilling rig. **Note:** The BLM does not approve of the use of flagging, strobe lights, metal reflectors, or noisemakers as techniques for deterring wildlife.

Minimum Netting Requirements

The operator will:

1. Construct a rigid structure made of steel tubing or wooden posts with cable strung across the pit at no more than 7-foot intervals along the X- and Y-axes to form a grid of 7-foot squares.
2. Suspend netting a minimum of 4 to 5 feet above the pit surface.
3. Use a maximum netting mesh size of 1½ inches to allow for snow loading while excluding most birds in accordance with U.S. Fish and Wildlife Service recommendations. Refer to: <http://www.fws.gov/mountain-prairie/contaminants/contaminants1c.html>.
4. Cover the top and sides of the netting support frame with netting and secure the netting at the ground surface around the entire pit to prevent wildlife entry at the netting edges. Note: Hog wire panels or other wire mesh panels or fencing used on the sides of the netting support frame is ineffective in excluding small wildlife and songbirds unless covered by smaller meshed netting.
5. Monitor and maintain the netting sufficiently to ensure the netting is functioning as intended, has not entrapped wildlife, and is free of holes and gaps greater than 1½ inches.

Escape Ramps (Open Pits and Cellars, Tanks, and Trenches) – The operator will construct and maintain pits, cellars, open-top tanks, and trenches, that are not otherwise fenced, screened, or netted, to exclude livestock, wildlife, and humans (for example, lined, clean water pits; well cellars; or utility trenches) to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in pits, cellars, open-top tanks, or at frequent intervals along trenches where entrapment hazards may exist.

Exclosure Netting (Open-top Tanks) – Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent

wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock.

Chemical and Fuel Secondary Containment and Exclosure Screening – The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable State or U. S. EPA livestock water standards in accordance with State law. The operator must not drain the fluids to the soil or ground.

The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems, such as fencing, netting, expanded metal mesh, lids, and grate covers.

Open-Vent Exhaust Stack Exclosures – The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Mitigation Outside the Area of Impact

BLM policy is to place a priority on mitigating impacts to an acceptable level onsite, to the extent practical, through avoidance, minimization, rectification, or reduction of impacts over time. There are times when onsite mitigation alone may not be sufficient to adequately mitigate impacts and achieve BLM resource and value objectives. In these cases, it may be appropriate to consider mitigation outside the area of impact (e.g., compensating for the impact) to achieve BLM resource and value objectives.

The priority order for mitigating resource impacts is to 1) avoid, 2) minimize, 3) rectify, or 4) reduce the impact over time, and, if necessary, 5) mitigate outside the area of impact, preferably at regionally selected mitigation sites. However, in some cases, mitigation sites near where the resource or value impact is occurring (but still outside the area of impact), will be the most appropriate location for performing mitigation activities.

Long-term Durability: The BLM should ensure that mitigation conducted outside the area of impact will, at a minimum, be effective for as long as the land-use authorization affects the resources and values. This would include the time it takes to appropriately restore the affected onsite resources and values after the expiration of the land-use authorization.

Monitoring: Long-term project monitoring and maintenance would be required for mitigation conducted outside the area of impact. Monitoring would involve adherence to performance objectives, methods for measuring effectiveness/success, reporting requirements, funding source, and responsible parties. Monitoring plans should reference and comply with BLM monitoring principles described in BLM's *Assessment, Inventory, and Monitoring Strategy* (AIM).

Mitigation outside the area of impact may consist of “in-kind” or “out-of-kind.” In-kind mitigation is the replacement or the substitution of resources or values that are of the same type and kind as those impacted.

Out-of-kind mitigation is the replacement or substitution of resources or values that are not the same type and kind as those impacted but are related or similar. In-kind mitigation is generally preferred to out-of-kind mitigation, although there may be exceptions depending on circumstances.

One acre of mitigation outside the area of impact may not necessarily be sufficient to compensate for one acre of direct onsite surface impact. Mitigation must be roughly proportional to the impact caused by the regulated activity and reasonably related to the impact.

BMPs for mitigation outside the area of impact (offsite) are as follows:

- In cases where offsite mitigation would provide greater benefits than onsite mitigation, the offsite mitigation should be located within the same landscape unit. Mitigation should be planned to offset the loss of habitat effectiveness or natural resources throughout the areas directly and indirectly affected by mineral operations.
- Offset the loss of important habitat and soils by completing rehabilitation and enhancement projects in appropriate locations outside the project area. These locations have been identified in the State of Utah's Watershed Restoration Initiative (WRI). Utah's WRI is a partnership-driven effort, which includes State and Federal agencies with a mission to conserve, restore, and manage ecosystems in priority areas across Utah.
- Habitat rehabilitation and enhancement projects may include, but are not limited to:
 1. Water developments
 - a. Springs/seeps
 - b. Wetland development
 - c. Ponds/reservoirs
 - d. Big game guzzlers
 - e. Wells/windmills for wildlife waters
 - f. All projects listed above may require annual maintenance
 2. Seeding and planting of grasses and shrubs
 3. Fencing or fencing upgrades to protect or enhance wildlife habitats
 4. Reclamation of previous disturbances, such as undesignated roads
 5. Watershed restoration
- Financial Contribution Agreements (Mitigation Trust Account): This voluntary option may be considered when it is not possible to avoid, minimize, or effectively mitigate impacts through other means. If recommended by the UDWR and approved by the BLM, the operator may contribute funding to a mitigation trust account based on the estimated cost of habitat treatments or other mitigation needed to restore the functions and effectiveness of impacted habitats. However, the preferred approach is for the operator to fund and implement successful habitat treatments after coordination with the BLM and UDWR, and under the BLM's direction and oversight. The operator can retain a subcontractor who specializes in mitigation and reclamation. The acreage basis for mitigation will be the amount of surface that is directly disturbed plus the additional area on which habitat functions are impaired by noise, activities, and other disturbance effects. Seasonal stipulations, standard management practices, and additional management prescriptions should still be applied and will be considered when determining how many acres of habitat are functionally impaired within a well field. Mitigation recommendations may be refined and possibly standardized as habitat treatments are implemented and their effectiveness monitored.

The area of land needed to mitigate an impact will depend on the types of treatments applied, the expected improvement to the functional capacity of the land, and the effectiveness of impact abatement (management) practices being applied within the project area. There is no set or standard mitigation ratio. If 100 percent of the habitat function is lost on an acre of land, then enough land needs to be treated such that the expected increment of improvement multiplied by the number of acres treated equals the acre-equivalent of habitat function lost.

BEST MANAGEMENT PRACTICES FOR POTASH PRODUCTION AND PROCESSING FACILITIES

Water

- Within the influence zones of waters and wetlands: 1) conduct a hydrologic review of aquifers to determine the flow patterns supporting water elements such as fens, emergent wetlands, springs, seeps, hanging gardens, streams, and ponds; and 2) avoid the use of evaporation ponds or other associated infrastructure that may easily become hydrologically connected with water resources.
- Develop a mitigation plan to minimize potential adverse impacts to groundwater resources through water conservation improvements, placement and construction of facilities, the use of liners and containments, a spill prevention, control and countermeasure plan (as specified by EPA), and a storm water management plan.
- A comprehensive water monitoring plan will be provided for approval by the BLM, where groundwater or surface water is to be utilized in or potentially impacted by potash processing facilities or other associated operations. The monitoring plan shall describe how and where monitoring wells will be operated to evaluate groundwater drawdown, water quality conditions, and the process for managing water usage as water levels in the wells and groundwater levels vary. Monitoring wells shall be used to collect baseline data, identify potential depletions of existing springs, wells, and other water bodies that may result from project pumping. Monitoring will occur prior to, during, and after anticipated potash development to detect impacts on both surface water and groundwater resources, including private and public well monitoring.

Siting of Facilities

- Siting of facilities shall be completed in coordination with the BLM to minimize impacts to natural and cultural resources. All facilities shall be monitored on a regular basis and controlled through regular field inspection and the use of automated sensing and shutdown equipment at strategic locations to minimize the potential for discharges or leaks. All monitoring, spill response, and remedial actions will comply with the items described in detail in a mine plan of operations and closure plan approved by the BLM.

Injection and Production/Extraction Wells

- A 10 foot x 6 foot concrete pad will be constructed within a 50-foot non-swelling, impervious clay pad.
- Well pads will be fenced to exclude access by people or animals.
- Area surrounding well pads will be bermed to contain any spills and stormwater.

- Backflow preventers will be installed to protect well integrity. An automatic monitoring and shutoff system will be implemented.
- Well management will be subject to the terms and conditions of the Utah Department of Environmental Quality Discharge Permit and/or an underground injection well permit.
- Well casings will be constructed to exceed Class III well standards. Casing materials will be designed to function in a highly saline environment.
- Well annular space and column pressure-sensing equipment will be installed.
- All injection and extraction wells will be equipped with automated monitoring systems to detect and report any brines that escape from the cavern development zones.
- All automated processes will be inspected, calibrated, and verified based on a regular inspection schedule to be established through a field operation and maintenance plan.

Pipelines

- Pipelines will be made of ultraviolet resistant high density polyethylene.
- Pipelines in the project area when buried will be at least 3 feet deep.
- Pipelines will avoid steep slopes.
- Where pipelines are on the surface, they will be buried every quarter mile to allow for range and wildlife movement as well as emergency access.
- Where pipelines must cross designated roads, the pipe will be installed by boring under the road to minimize traffic disruption.
- Pipeline right-of-ways (ROW) will be located along existing roads or other ROWs to limit surface impacts to already disturbed areas.
- Automated sensing and shutdown equipment will be installed along the pipelines to minimize the potential for discharges or leaks of the transported brines.
- The pipelines will be inspected regularly in the field. All monitoring, spill response, and remedial actions will comply with the items described in detail in a Mine Plan and Closure Plan approved by the BLM.
- Lift and booster stations – if these facilities are necessary, all designs will include check valves to account for anti-backflow or siphon conditions and instrumentation to monitor pipeline performance and adjust interdependent flow rates and pressures.
- Where surface pipelines cross existing drainages or intersect points with large contributing drainage areas, the pipelines must 1) be buried below potential scour depth and stabilized with rock to minimize the potential for erosion, or 2) washes shall be spanned with supports located within and at the edge of the floodplain.
- Minimize the placement of underground pipelines in areas with shallow unconfined aquifers.

Power Lines

- Anti-perch equipment and other raptor protection will be installed on new power lines.

Roads

- Vehicle access will utilize designated roads where possible.
- Pipeline inspection roads to be constructed will be limited to a 12-foot width.
- Maintain stable roads and minimize soil erosion by providing a base of up to 6 inches of gravel along the running surface.

Ponds

- Ponds will be lined with a minimum of 60 mil geosynthetic liners over graded, screened, and compacted subgrade material. The liner will be covered by an 18-inch-thick layer of salt or clay that will harden to provide protection for the liner and minimize the potential for leaks.
- Ponds will be constructed with freeboard to minimize the potential for overtopping and spills.
- Develop an avian monitoring and mitigation plan designed to anticipate and prevent use of the ponds by waterfowl.
- Surface water runoff from offsite will be directed away from the ponds by diversion ditches. Onsite stormwater will be contained onsite with berms.
- A leak detection system will be installed per the State of Utah Discharge Permit.

Soil

- The top 6 inches of topsoil from the construction of evaporation ponds and other related processing facilities will be removed, stockpiled, and stabilized with vegetation.
- The stockpile will have a flat top and 2:1 side slopes.
- The stockpile will be bermed to prevent erosion and revegetated until the end of the project life.
- Monitor the topsoil stockpiles for erosion quarterly and after large precipitation events.
- See additional BMPs for soils in previous section.

Reclamation

- All wells will be plugged and abandoned in accordance with applicable rules and regulations.
- All pond liners will be shredded onsite and removed to a permitted landfill.
- The hardened salt and/or clay layer on top of the pond liners will be excavated and disposed of according to the requirements of the State of Utah Discharge Permit.
- All ancillary equipment will be demolished, razed, and recycled or transported to a permitted landfill for proper disposal.

- Following the removal of all structures and infrastructure, disturbed areas will be graded and planted with native seed mixtures. Site preparation, planting, and monitoring will be performed in consultation with the BLM, with a goal of returning the property to beneficial post-mining land uses similar to pre-project conditions.
- During reclamation, compacted areas will be subsoiled or ripped to the depth of compaction to prepare the seed bed, encourage surface water infiltration, and minimize post-reclamation accelerated runoff and erosion.
- For those soils that are difficult to revegetate, structural erosion control measures will be employed. Regular monitoring of revegetated and reclaimed areas will be implemented, with regular maintenance or reseeded, as needed, until the BLM determines that the revegetation is successful.
- See additional BMPs for reclamation in previous section.

Construction

- A qualified person will be onsite at all times to monitor construction activities for compliance with Federal and State permits and requirements. This construction monitor would report to the BLM on a regular basis.

Subsidence

- Though not expected to occur, the operator will be responsible for any impacts caused by subsidence in the project area resulting from the solution mining operation.

Salt Management Areas and Potash Stockpile Areas

- Salt (halite) management areas would be placed in bermed and lined containment areas as approved by the BLM.
- Potash stockpile areas would be placed in bermed and lined containment areas as approved by the BLM.